

Gunter, Jason

From: James, Kevin <kjames@doerun.com>
Sent: Thursday, December 11, 2014 7:36 AM
To: Gunter, Jason
Cc: Yingling, Mark; Neaville, Chris; Montgomery, Michael; 'robert.hinkson@dnr.mo.gov'; 'brandon.wiles@dnr.mo.gov'; 'Ty Morris (TMorris@barr.com)'
Subject: OLB Air Monitoring - November
Attachments: removed.txt; 4th Qtr 2014 Park Hills PM10 Lead Samplers Performance Audit Report.pdf; Remediation Air Report with 4thQ Audit - October 2014.pdf

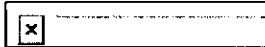
Categories: Red Category

Jason -

Attached is the data for November and 4th quarter air results for the OLB.

Kevin James

Kevin James



Environmental Engineering
W: 573.626.2096
C: 573.247.6766

This message is intended solely for the designated recipient and may contain confidential, privileged or proprietary information. If you have received it in error, please notify the sender immediately and delete the original and any copy or printout. Please note that any views or opinions presented in this e-mail are solely those of the author and do not necessarily represent those of The Doe Run Company. Finally, the recipient should check this message and any attachments for the presence of viruses or malware. The Doe Run Company accepts no liability for any loss or damage caused through the transmission of this e-mail.

07CR

40482431



Superfund

4.2

01102

INQUEST
ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ♦ COLUMBIA, MO 65202
(573) 474-8110 ♦ FAX: (573) 474-8371

November 11, 2014

Mr. Greg Henson
Chemist
The Doe Run Company
881 Main Street
Herculaneum, Missouri 63048

RE: 4th Quarter 2014 Lead/PM10 Samplers and Meteorological System
Performance Audit Report.

Dear Mr. Henson,

Please find enclosed the worksheets detailing the Lead/PM10 sampler's one-point flow verifications and meteorological sensors accuracy checks that were recently performed on the Doe Run Park Hills Monitoring Network. A copy of the current certifications for the audit devices that were used has also been enclosed.

All of the verifications and checks were found to be within expected guidelines.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for your business.

Sincerely,



John A. Kunkel
Inquest Environmental, Inc.

PM10 Sampler Verifications

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 Primary PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P2952	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.067	23.80	44.45	0.942	1.141	6.94	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.30	43.52	0.943	1.142	1.063	-5.93	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 QA PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P1019	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.20	1.084	25.00	46.69	0.939	1.150	6.09	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.80	46.32	0.939	1.150	1.080	-4.42	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P2950	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate	Acceptable
Manometer	Flow Rate	Manometer	Pressure	Press. Ratio	Flow Rate	Percent	Range
"H ₂ O	m ³ /min	"H ₂ O	(Pf)	(Po/Pa)	m ³ /min	Difference	
3.20	1.084	23.20	43.33	0.943	1.140	5.17	± 7%

Sampler Operating Flow Rate						
Manometer	Pressure	Press. Ratio	Flow Rate	Corrected	Design %	Acceptable
"H ₂ O	(Pf)	(Po/Pa)	m ³ /min	Flow Rate	Difference	Range
23.50	43.89	0.943	1.140	1.081	-4.34	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	<u>October 8, 2014</u>	Auditor	<u>John Kunkel</u>
Operator	<u>The Doe Run Company</u>	Transfer Orifice	<u>1882</u>
Location	<u>Park Hills Network</u>	Slope (Qa)	<u>1.03497</u>
Station	<u>St. Joe Park</u>	Intercept (Qa)	<u>-0.00227</u>
Sampler	<u>#4 PM10</u>	Temperature	<u>23.8</u> °C <u>297.0</u> °K
Flow Controller	<u>P4353</u>	Station Pressure	<u>30.14</u> "Hg <u>765.6</u> mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.062	23.40	43.70	0.943	1.127	6.12	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.50	43.89	0.943	1.158	1.087	-3.81	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	<u>October 8, 2014</u>	Auditor	<u>John Kunkel</u>
Operator	<u>The Doe Run Company</u>	Transfer Orifice	<u>1882</u>
Location	<u>Park Hills Network</u>	Slope (Qa)	<u>1.03497</u>
Station	<u>Hanley Park</u>	Intercept (Qa)	<u>-0.00227</u>
Sampler	<u>#2 PM10</u>	Temperature	<u>23.8 °C</u> <u>297.0 °K</u>
Flow Controller	<u>P2949</u>	Station Pressure	<u>30.13 "Hg</u> <u>765.3 mmHg</u>

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate	Acceptable
Manometer	Flow Rate	Manometer	Pressure	Press. Ratio	Flow Rate	Percent	Range
"H ₂ O	m ³ /min	"H ₂ O	(Pf)	(Po/Pa)	m ³ /min	Difference	
3.10	1.062	23.10	43.14	0.944	1.135	6.87	± 7%

Sampler Operating Flow Rate						
Manometer	Pressure	Press. Ratio	Flow Rate	Corrected	Design %	Acceptable
"H ₂ O	(Pf)	(Po/Pa)	m ³ /min	Flow Rate	Difference	Range
23.20	43.33	0.943	1.158	1.078	-4.60	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Water Plnt)	Intercept (Qa)	-0.00227
Sampler	#3 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P2951	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.20	1.079	23.10	43.14	0.944	1.141	5.75	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.10	43.14	0.944	1.141	1.075	-4.87	± 10%

Calculations:

Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Quarry)	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P4601	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.066	23.40	43.70	0.943	1.115	4.60	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.116	1.065	-5.75	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Wood Street)	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	25.0 °C 298.2 °K
Flow Controller	P4507	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.064	23.40	43.70	0.943	1.132	6.39	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.60	44.08	0.942	1.131	1.059	-6.28	± 10%

Calculations:

Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P1018	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.20	1.084	22.90	42.77	0.944	1.158	6.83	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.158	1.079	-4.51	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood (school)	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P6071	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate	Acceptable
Manometer	Flow Rate	Manometer	Pressure	Press. Ratio	Flow Rate	Percent	Range
"H ₂ O	m ³ /min	"H ₂ O	(Pf)	(Po/Pa)	m ³ /min	Difference	
3.30	1.101	22.90	42.77	0.944	1.168	6.09	± 7%

Sampler Operating Flow Rate						
Manometer	Pressure	Press. Ratio	Flow Rate	Corrected	Design %	Acceptable
"H ₂ O	(Pf)	(Po/Pa)	m ³ /min	Flow Rate	Difference	Range
23.00	42.96	0.944	1.168	1.097	-2.92	± 10%

Calculations:

 Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood (south)	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P1500	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.30	1.097	23.40	43.70	0.943	1.152	5.01	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.152	1.094	-3.19	± 10%

Calculations:

Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Lead/TSP Sampler Verifications

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River Primary	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P4557	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.165	24.60	45.96	0.940	1.233	5.84	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
24.70	46.15	0.940	1.233	1.161	1.10 - 1.70

Calculations:Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River QA	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P1019	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.50	1.133	24.20	45.21	0.941	1.153	1.77	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
24.00	44.84	0.941	1.153	1.133	1.10 - 1.70

Calculations:Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P2939	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.165	23.50	43.91	0.943	1.233	5.84	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.40	43.72	0.943	1.233	1.161	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P6792	Station Pressure	30.14 "Hg 765.6 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.160	23.30	43.53	0.943	1.224	5.52	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.20	43.35	0.943	1.224	1.156	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Hanley Park	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4474	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.144	23.60	44.09	0.942	1.213	6.03	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.942	1.213	1.140	1.10 - 1.70

Calculations:

 Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

 Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Water Plant	Intercept (Qa)	-0.00227
Sampler	#3 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4475	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.144	23.70	44.28	0.942	1.220	6.64	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.220	1.139	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	<u>October 8, 2014</u>	Auditor	<u>John Kunkel</u>
Operator	<u>The Doe Run Company</u>	Transfer Orifice	<u>1882</u>
Location	<u>Park Hills Network</u>	Slope (Qa)	<u>1.03497</u>
Station	<u>Rivermines Quarry</u>	Intercept (Qa)	<u>-0.00227</u>
Sampler	<u>#1 TSP</u>	Temperature	<u>26.1 °C</u> <u>299.3 °K</u>
Flow Controller	<u>P2940</u>	Station Pressure	<u>30.11 "Hg</u> <u>764.8 mmHg</u>

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.149	24.10	45.03	0.941	1.227	6.79	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
24.30	45.40	0.941	1.227	1.144	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Wood St.	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	25.0 °C 298.2 °K
Flow Controller	P2941	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.147	23.80	44.47	0.942	1.227	6.97	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.80	44.47	0.942	1.227	1.141	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P1018	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.50	1.133	23.40	43.72	0.943	1.157	2.12	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.30	43.53	0.943	1.157	1.132	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood School	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P6793	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.150	23.30	43.53	0.943	1.223	6.35	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.50	43.91	0.943	1.223	1.145	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood South	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4559	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.161	23.80	44.47	0.942	1.237	6.55	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.942	1.237	1.156	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Calibration Orifice Certification Worksheet



TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 09, 2014 Rootsmeter S/N 0438320 Ta (K) - 292
Operator Tisch Orifice I.D. - 1882 Pa (mm) - 759.46

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3530	4.1	1.50
2	NA	NA	1.00	1.0430	6.8	2.50
3	NA	NA	1.00	0.9510	8.1	3.00
4	NA	NA	1.00	0.8790	9.5	3.50
5	NA	NA	1.00	0.6660	16.3	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0143	0.7496	1.2368		0.9945	0.7350	0.7594
1.0106	0.9690	1.5967		0.9910	0.9501	0.9804
1.0089	1.0608	1.7491		0.9893	1.0402	1.0740
1.0070	1.1456	1.8893		0.9874	1.1233	1.1600
0.9978	1.4983	2.4736		0.9784	1.4691	1.5188
Qstd slope (m) = 1.65282				Qa slope (m) = 1.03497		
intercept (b) = -0.00370				intercept (b) = -0.00227		
coefficient (r) = 0.99999				coefficient (r) = 0.99999		
y axis = SQRT[H2O(Pa/760) (298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{ [SQRT(H2O(Pa/760) (298/Ta))] - b}
Qa = 1/m{ [SQRT H2O(Ta/Pa)] - b}

Meteorological Sensor's Accuracy Checks

Inquest Environmental, Inc.

Wind Direction Sensor Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Technician M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Mfg RM Young
 Sensor Model Wind Monitor AQ
 Serial Number 128618
 Sensor Height 10.0 Meters

Station Declination 0.0 Deg
 Measured Angle 180.0 Deg
 Corrected Angle 180.0 Deg
 Alignment Error 0.0 Deg

Vane Angle	Data Logger	Results	
		Difference ± 3 Deg Limit	Total Error ± 5 Deg Limit
Degrees	Degrees		
0/360	0.6	0.6	0.6
90	89.7	-0.3	-0.3
180	181.1	1.1	1.1
270	270.4	0.4	0.4

Average Difference (Degrees)	0.4
Average Total Error (Degrees)	0.4

Audit Device	Wind Vane Alignment	Direction
Type	Pocket Transit	Vane Angle Fixture
Mfg.	Brunton	R.M. Young
Model	5008	18212
Serial No.	5080304492	None

Comments: Wind direction was verified by determining the orientation of the sensor in respect to True North. This was measured using a tri-pod mounted transit aligned along the length of the sensor while locked from rotating. A magnetic declination of 0 degrees was used to determine True North. The linearity of the sensor was determined by aligning the sensor to an indexed test fixture provided by the manufacturer. The four cardinal directions were verified using the fixture. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Wind Speed Sensor Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Auditor(s) M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Mfg RM Young
 Sensor Model Wind Monitor AQ
 Serial Number 128618
 Sensor Height 10.0 Meters

Audit Standard		DAS Response		Limit
RPM	MPH	MPH	Difference	MPH
Zero	0.00	0.00	0.00	0.45
300	3.44	3.43	-0.01	0.62
600	6.87	6.87	0.00	0.79
1200	13.74	13.74	0.00	1.14
1800	20.61	20.61	0.00	1.48
3600	41.22	41.20	-0.02	2.51
5400	61.83	61.80	-0.03	3.54
Average			-0.01	

± (0.45 MPH + 5%)

Audit Device	Anemometer Drive
Type	Variable Speed
Mfg.	R.M. Young
Model	18801
Serial No.	CAO1631

Comments: Wind speed was verified using a variable speed anemometer drive. The propellor was removed from the sensor and the drive was connected using a flexible connector. The sensor was then rotated in the appropriate direction at several different speeds. Sensor responses were taken from the data logger. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Temperature Sensor Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Technician M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Information

Sensor Mfg Climatronics
 Sensor Model NA
 Serial Number NA
 Sensor Height 2 meters

Audit Device °C	Sensor	
	Data Logger °C	Difference °C
0.0	0.2	0.2
17.7	17.9	0.2
35.1	35.4	0.3
Average		0.2

Note: The limit for each point is +/- 0.5 °C

Audit Device	
Type	Digital Thermometer
Mfg.	Control Company
Model	15-077-7
Serial No.	72415694

Comments: The temperature is verified by co-locating the sensor with a certified digital thermometer. The verification is conducted at three levels using two water baths (iced and hot water) and the ambient temperature. The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital thermometer. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Barometric Pressure Sensor Performance Audit

Operator The Doe Run Co
Location Big River
Station Name Meteorological System
Technician M Kunkel / C Boston

Date 10/29/2014
Start Time 11:15
Stop Time 12:30

Sensor Mfg Setra
Sensor Model 276
Serial Number 2626447

Audit Device	Data Logger Response	
	BP mm HG	Difference mm HG
745.60	749.62	4.02

Note: Limit is +/- 7.5 mm HG.

Audit Device	
Type	Digital Barometer
Mfg.	AIR
Model	AIR-HB-1A
Serial No.	6G3745

Comments: The barometric pressure is verified by co-locating the sensor with a certified
digital barometer. The verification was conducted at one level after
allowing the sensor and calibration device ample time to stabilize.
The sensor error was determined by comparing the sensor's data logger
response to the display on the certified digital barometer. No
adjustments were made to the sensor.

Inquest Environmental, Inc.

Precipitation Gauge Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Technician M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Mfg Texas Electronics
 Sensor Model TR525I
 Serial Number 36611-805
 Diameter (inches) 6.00

Audit Device	Data Logger Response	
	Gauge Tips	Difference %
Known Tips		
96.00	89.00	-7.29

Note: Limit is +/- 10%.

Audit Device	
Type	Graduated Beaker
Mfg.	Texas Instruments
Model	FC-525
Serial No.	NA

Comments: The precipitation gauge output was verified using a field calibration kit supplied by the manufacturer. The kit consists of a graduated beaker and a calibration funnel using a precision orifice at the water outlet. Water was measured in the beaker and poured into the funnel while mounted on the gauge. The amount of precipitation recorded by the data logger was then compared to the known amount of water passing through the funnel. 100 tips equals one inch of rainfall. The gauge was cleaned and no adjustments were made.

Meteorological Audit Devices Certifications

BRUNTON OUTDOOR GROUP

CERTIFICATE OF CALIBRATION

Equipment Owner

Name: Environmental Atten: Mitchell Kunkel
Address: 3609 Mojave Court Ste E
Columbia, MO 65202

Calibration traceable to the National Institute of Standards and Technology in accordance with MIL-STD-45662A has been accomplished on the instrument listed below by comparison with standards maintained by the Brunton Outdoor Group. The accuracy and stability of all standards maintained by the Brunton Outdoor Group are traceable to national standards maintained by the National Institute of Standards and Technology in Washington, D.C. and Boulder, CO. Completed record of all work performed is maintained by the Brunton Outdoor Group and is available for inspection upon request.

This unit has been calibrated to Lietz TM10E serial number 30937 traceable to N.B.S. Number 738227675 this 16TH Day May 20 13.

Description Pocket Transit

Purchase Order RA 256426895

Order Number SO-042272

Model Number F-5008

Serial Number 5080304492

Calibration Date May 16, 2013

Recalibration Date May 16, 2014

Signed Patricia K. Shuter

Quality Control Coordinator



CALIBRATION PROCEDURE
18801/18810 ANEMOMETER DRIVE

DWG: CP18801(A)

REV: C101107 PAGE: 2 of 3
BY: TJT DATE: 10/11/07
CHK: JC W.C. GAS-12

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: **18801** (Comprised of Models 18820 Control Unit & 18830 Motor Assembly)
SERIAL NUMBER: CA01631

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	Output Frequency Hz (1)	Calculated Rpm (2)	Indicated Rpm (3)
600	320	600	600
1200	640	1200	1200
2400	1280	2400	2400
4200	2240	4200	4200
6,000	3200	6000	6000
8,100	4320	8100	8100
9,900	5280	9900	9900
<input checked="" type="checkbox"/> Clockwise and Counterclockwise rotation verified			

- (1) Measured at the optical encoder output.
(2) Frequency output produces 32 pulses per revolution of motor shaft.
(3) Indicated on the Control Unit LCD display.

* Indicates out of tolerance

☒ No Calibration Adjustments Required ☐ As Found ☐ As Left

Traceable frequency meter used in calibration Model: DP5740 SN: 4683

Date of inspection 15 Nov 2013
Inspection Interval One Year

Tested By EC



Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC
17025, ANSI/NCSL Z540-1, and 9001



Cert. No.: 4000-5654260

Traceable® Certificate of Calibration for Digital Thermometer

Cust ID: Inquest Environmental Inc., 3609 Mojave Ct. Suite E, Attn: Mitchell Kunkel, Columbia, MO 65202 U.S.A. (RMA:983601)

Instrument Identification:

Model Numbers: 15-077-8, FB50266, 245BY S/N: 21357521 Manufacturer: Control Company
Model: 15-077-7 S/N: 72415694

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/13/14	1000332071
Temperature Probe	128	2/20/14	6-B48Z9-30-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5202	11/30/14	15-B15PW-1-1
Temperature Calibration Bath TC-275	B16388		
Digital Thermometer	B16815	8/12/14	1000341967
PRT Temperature Probe	02022	8/14/15	B3812004

Certificate Information:

Technician: 68 Procedure: CAL-06
Test Conditions: 24.5°C 32.0 %RH 1026 mBar

Cal Date: 1/17/14

Cal Due: 1/17/15

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	0.006	Y	0.000	0.000	Y	-0.050	0.050	0.013	3.8:1
°C	25.003	25.003	Y	25.003	24.999	Y	24.953	25.053	0.023	2.2:1
°C	60.000	59.988	Y	60.000	60.002	Y	59.950	60.050	0.014	3.6:1
°C	99.998	99.961	Y	99.998	100.000	Y	99.948	100.048	0.018	2.8:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy= $\pm(\text{Max}-\text{Min})/2$; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice
Aaron Judice, Technical Manager

Maintaining Accuracy:

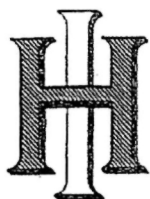
In our opinion once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2008-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).



HASS INSTRUMENT CORPORATION

6711 OLD BRANCH AVENUE • CAMP SPRINGS, MD 20748-6990 • (301) 449-5454 • FAX (301) 449-5455

CALIBRATION REPORT

BAROMETER/ALTIMETER
AIR Model AIR-HB-1A
Serial No. 6G3745

TEST POINT	TEST PRESSURE	DIGITAL READOUT	READOUT ERROR	CORRECTION REQUIRED
1	930.00	931.9	+1.9	-1.9
2	970.00	971.9	+1.9	-1.9
3	1010.00	1012.0	+2.0	-2.0
4	1050.00	1051.9	+1.9	-1.9
5	1018.01	1019.9	+1.9	-1.9

NOTES:

1. All data are in Millibars (hPa) and were taken at 75 F (24 C).
2. To correct the Digital Readout of the instrument, either algebraically add the CORRECTION REQUIRED to, or algebraically subtract the READOUT ERROR from, the readout shown on the instrument.
3. The TEST PRESSURE was generated using Type A-1 Barometer S/N 3327, and was approached in an increasing-pressure direction.
4. The TEST PRESSURE for TEST POINT 5 was ambient atmospheric pressure.
5. The BAROMETER/ALTIMETER was horizontal during the calibration.
6. The LCD screen of the BAROMETER/ALTIMETER has some trash in the center of the display, but it does not interfere with the readout.
7. Although the Digital Readout of the instrument can be adjusted to incorporate the average CORRECTION REQUIRED, this has not been done.

Calibration Date: 5 February 2014

By: Bernard I. Hass

Bernard I. Hass

(SEAL)

Monthly Ambient Air Monitoring Report

The Doe Run Company
Old Lead Belt Sites:
Federal, Rivermines, National, and Leadwood

October-2014



SUITE 300
1801 PARK 270 DRIVE
ST. LOUIS, MO 63146

Federal Site

Sample Results for **October-2014**

	St. Joe (Ballfields)		Big River#4		Water Treatment Plant	
Sample Date	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	39	0.021	35	0.014	39	0.007
10/2/14	12	0.007	8	0.007	13	0.028
10/3/14	12	0.007	10	0.000	15	0.028
10/6/14	9	0.007	3	0.007	7	0.021
10/7/14	15	0.007	11	0.014	13	0.049
10/8/14	13	0.014	21	0.013	16	0.014
10/9/14	7	0.000	12	0.007	12	0.007
10/10/14	3	0.000	43	0.007	3	0.000
10/13/14	2	0.000	2	0.000	2	0.000
10/14/14	5	0.000	0	0.007	1	0.000
10/15/14	5	0.007	4	0.007	6	0.021
10/16/14	15	0.138	12	0.007	14	0.021
10/17/14	27	0.021	25	0.007	28	0.078
10/20/14	27	0.041	20	0.007	23	0.055
10/21/14	22	0.014	26	0.007	52	0.156
10/22/14	15	0.013	15	0.007	31	0.094
10/23/14	14	0.149	10	0.013	37	0.068
10/24/14	12	0.021	14	0.013	20	0.041
10/27/14	93	0.141	30	0.007	44	0.049
10/28/14	13	0.007	8	0.007	6	0.021
10/29/14	9	0.007	15	0.013	10	0.020
10/30/14	12	0.034	10	0.013	6	0.007
10/31/14	21	0.007	14	0.000	17	0.007

Monthly Avg. TSP	17	15	18
Monthly Avg. Pb	0.029	0.008	0.034
Sep-14	0.009	0.013	0.017
Aug-14	0.014	0.019	0.024
Rolling 3-Month	0.017	0.014	0.025

Three month rolling average must be less than 0.15 ug/m3

NOTES:

	Big River QA	
Sample Date	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
10/30/14	12	0.013

Rivermines

Sample Results for **October-2014**

	Big River #4		Rivermines South #1		Rivermines North #2		Rivermines East #3	
Sample Date	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	35	0.014	38	0.014	invalid	invalid	39	0.007
10/2/14	8	0.007	invalid	invalid	6	0.035	13	0.028
10/3/14	10	0.000	13	0.006	11	0.000	15	0.028
10/6/14	3	0.007	5	0.007	7	0.021	7	0.021
10/7/14	11	0.014	20	0.062	19	0.077	13	0.049
10/8/14	21	0.013	24	0.054	17	0.007	16	0.014
10/9/14	12	0.007	11	0.007	20	0.000	12	0.007
10/10/14	43	0.007	5	0.000	3	0.000	3	0.000
10/13/14	2	0.000	0	0.000	4	0.007	2	0.000
10/14/14	0	0.007	0	0.000	1	0.007	1	0.000
10/15/14	4	0.007	10	0.013	5	0.041	6	0.021
10/16/14	12	0.007	12	0.007	17	0.042	14	0.021
10/17/14	25	0.007	33	0.026	21	0.000	28	0.078
10/20/14	20	0.007	31	0.047	20	0.007	23	0.055
10/21/14	26	0.007	73	0.405	23	0.007	52	0.156
10/22/14	15	0.007	17	0.033	11	0.020	31	0.094
10/23/14	10	0.013	23	0.066	10	0.014	37	0.068
10/24/14	14	0.013	30	0.052	12	0.021	20	0.041
10/27/14	30	0.007	34	0.014	41	0.233	44	0.049
10/28/14	8	0.007	18	0.047	9	0.014	6	0.021
10/29/14	15	0.013	26	0.078	7	0.007	10	0.020
10/30/14	10	0.013	12	0.013	18	0.094	6	0.007
10/31/14	14	0.000	68	0.324	17	0.007	17	0.007

Monthly Avg. TSP	15	23	14	18
Monthly Avg. Pb	0.008	0.058	0.030	0.034
Sep-14	0.013	0.051	0.032	0.017
Aug-14	0.019	0.087	0.043	0.024
Rolling 3-Month	0.014	0.065	0.035	0.025

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Rivermines North - 10/1, <23hr run time

Rivermines South - 10/2, <23hr run time, motor bearing failure

	Big River QA	
Sample Date	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
9/30/14	32	0.021

National Site

Sample Results for **October-2014**

	Big River #4		Ozark #1		Soccer Park #2		Water Treatment Plant	
Sample Date	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	35	0.014	48	0.014	46	0.021	39	0.007
10/2/14	8	0.007	10	0.007	11	0.007	13	0.028
10/3/14	10	0.000	11	0.000	13	0.000	15	0.028
10/6/14	3	0.007	invalid	invalid	10	0.021	7	0.021
10/7/14	11	0.014	invalid	invalid	14	0.021	13	0.049
10/8/14	21	0.013	invalid	invalid	18	0.014	16	0.014
10/9/14	12	0.007	invalid	invalid	8	0.007	12	0.007
10/10/14	43	0.007	3	0.000	5	0.000	3	0.000
10/13/14	2	0.000	2	0.000	2	0.007	2	0.000
10/14/14	0	0.007	2	0.000	1	0.000	1	0.000
10/15/14	4	0.007	11	0.020	9	0.021	6	0.021
10/16/14	12	0.007	27	0.014	24	0.014	14	0.021
10/17/14	25	0.007	39	0.007	31	0.007	28	0.078
10/20/14	20	0.007	29	0.007	25	0.014	23	0.055
10/21/14	26	0.007	27	0.014	26	0.014	52	0.156
10/22/14	15	0.007	18	0.007	18	0.013	31	0.094
10/23/14	10	0.013	17	0.013	20	0.014	37	0.068
10/24/14	14	0.013	15	0.014	18	0.021	20	0.041
10/27/14	30	0.007	43	0.028	43	0.035	44	0.049
10/28/14	8	0.007	9	0.007	11	0.014	6	0.021
10/29/14	15	0.013	16	0.007	11	0.007	10	0.020
10/30/14	10	0.013	11	0.007	16	0.007	6	0.007
10/31/14	14	0.000	20	0.007	28	0.007	17	0.007

Monthly Avg. TSP	15	19	18	18
Monthly Avg. Pb	0.008	0.009	0.012	0.034
Sep-14	0.013	0.009	0.016	0.017
Aug-14	0.019	0.012	0.015	0.024
Rolling 3-Month	0.014	0.010	0.014	0.025

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Ozark #1 - 10/6 thru 10/9, <23hr run times - bad GFI breaker replaced.

	Big River QA	
Sample Date	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
9/30/14	32	0.021

Leadwood

Sample Results for **October-2014**

	Big River #4		Leadwood South #1		Leadwood East #2		Leadwood North #3	
Sample Date	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3	TSP ug/m3	Lead ug/m3
10/1/14	35	0.014	105	0.096	107	0.096	37	0.007
10/2/14	8	0.007	19	0.007	39	0.021	9	0.000
10/3/14	10	0.000	14	0.007	11	0.000	11	0.000
10/6/14	3	0.007	16	0.007	7	0.007	3	0.007
10/7/14	11	0.014	9	0.007	9	0.007	8	0.007
10/8/14	21	0.013	20	0.013	31	0.007	12	0.007
10/9/14	12	0.007	8	0.007	6	0.007	7	0.000
10/10/14	43	0.007	6	0.007	6	0.000	3	0.000
10/13/14	2	0.000	1	0.000	1	0.000	0	0.000
10/14/14	0	0.007	1	0.000	0	0.000	1	0.000
10/15/14	4	0.007	6	0.007	7	0.007	9	0.007
10/16/14	12	0.007	12	0.007	14	0.000	7	0.007
10/17/14	25	0.007	30	0.007	22	0.000	25	0.000
10/20/14	20	0.007	22	0.007	20	0.007	17	0.007
10/21/14	26	0.007	26	0.013	28	0.007	25	0.007
10/22/14	15	0.007	12	0.013	20	0.026	14	0.013
10/23/14	10	0.013	26	0.013	17	0.020	20	0.007
10/24/14	14	0.013	17	0.013	13	0.020	12	0.014
10/27/14	30	0.007	35	0.014	43	0.049	24	0.014
10/28/14	8	0.007	2	0.007	8	0.007	6	0.007
10/29/14	15	0.013	15	0.013	12	0.007	14	0.007
10/30/14	10	0.013	9	0.007	21	0.033	7	0.007
10/31/14	14	0.000	21	0.006	18	0.006	14	0.000

Monthly Avg. TSP	15	19	20	12
Monthly Avg. Pb	0.008	0.012	0.014	0.005
Sep-14	0.013	0.019	0.026	0.006
Aug-14	0.019	0.020	0.026	0.004
Rolling 3-Month	0.014	0.017	0.022	0.005

Three month rolling average must be less than 0.15 ug/m3

NOTES:

	Big River QA	
Sample Date	TSP ug/m3	Lead ug/m3
10/2/14	10	0.007
10/7/14	12	0.007
10/9/14	28	0.007
10/14/14	0	0.000
10/16/14	12	0.007
10/21/14	23	0.007
10/23/14	8	0.007
10/28/14	9	0.007
9/30/14	32	0.021

Federal Site

Sample Results for **October-2014**

Sample Date	St. Joe (Ballfields) PM10 (ug/m3)	Big River#4 PM10 (ug/m3)	Water Treatment PM10 (ug/m3)
10/2/14	20	16	18
10/5/14	10	9	9
10/8/14	16	16	11
10/11/14	10	10	9
10/14/14	8	0	0
10/17/14	19	0	23
10/20/14	21	invalid	60
10/23/14	34	19	87
10/26/14	41	98	109
10/29/14	17	127	122

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	19	33	45
--------------------------	----	----	----

NOTES: Big River #4 - 10/20, <23hr run time, breaker tripped

Sample Date	Big River QA PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

Rivermines

Sample Results for **October-2014**

	Big River #4	Rivermines South #1	Rivermines North #2	Rivermines East #3
Sample Date	PM10 (ug/m3)	PM10 (ug/m3)	PM10 (ug/m3)	PM10 (ug/m3)
10/2/14	16	15	12	18
10/5/14	9	8	8	9
10/8/14	16	18	13	11
10/11/14	10	10	10	9
10/14/14	0	1	1	0
10/17/14	0	23	11	23
10/20/14	invalid	36	25	60
10/23/14	19	40	13	87
10/26/14	98	52	102	109
10/29/14	127	53	30	122

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	33	25	23	45
--------------------------	----	----	----	----

NOTES: Big River #4 - 10/20, <23hr run time, breaker tripped

	Big River QA
Sample Date	PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

National Site

Sample Results for **October-2014**

Sample Date	Big River #4 PM10 (ug/m3)	Ozark #1 PM10 (ug/m3)	Soccer Park #2 PM10 (ug/m3)	Water Treatment PM10 (ug/m3)
10/2/14	16	17	18	18
10/5/14	9	7	11	9
10/8/14	16	14	15	11
10/11/14	10	8	8	9
10/14/14	0	18	0	0
10/17/14	0	16	14	23
10/20/14	invalid	47	30	60
10/23/14	19	21	23	87
10/26/14	98	55	39	109
10/29/14	127	42	9	122

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	33	25	17	45
--------------------------	----	----	----	----

NOTES: Big River #4 - 10/20, <23hr run time, breaker tripped

Sample Date	Big River QA PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

Leadwood

Sample Results for **October-2014**

	Big River #4	Leadwood South #1	Leadwood East #2	Leadwood North #3
Sample Date	PM10 (ug/m3)	PM10 (ug/m3)	PM10 (ug/m3)	PM10 (ug/m3)
10/2/14	16	18	22	17
10/5/14	9	10	invalid	8
10/8/14	16	12	8	11
10/11/14	10	7	6	9
10/14/14	0	0	0	0
10/17/14	0	24	15	11
10/20/14	invalid	13	29	22
10/23/14	19	19	14	14
10/26/14	98	65	80	32
10/29/14	127	110	36	48

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	33	28	23	17
--------------------------	----	----	----	----

NOTES:

Leadwood East #2 - 10/5, <23hr run time

Big River #4 - 10/20, <23hr run time, breaker tripped

	Big River QA
Sample Date	PM10 (ug/m3)
10/2/14	16
10/8/14	16
10/14/14	4
10/20/14	86
10/26/14	103

Meterological Data - Old Lead Belt October-2014

24hr average

Date	Wind Speed (MPH)	Wind Direction	Sigma-Theta	Temperature (C)	Air Pressure (mmHg)	Rain (Inches)	Power Supply (Volts)
01-Oct-14	4.67	187	26.78	22.17	741	0	13.25
02-Oct-14	4.925	185.9	29.42	22.51	740	1.45	13.21
03-Oct-14	3.539	271.1	37.58	12.99	742	0.05	13.33
04-Oct-14	3.064	246.4	32.88	7.63	744	0	13.43
05-Oct-14	2.394	220	30.94	13.67	739	0	13.41
06-Oct-14	2.142	235	31	15.53	739	0.02	13.35
07-Oct-14	3.264	234	32.05	18.68	741	0.05	13.32
08-Oct-14	2.073	225.9	33.49	16.92	746	0.05	13.31
09-Oct-14	3.122	64.4	37.48	16.87	745	1.46	13.35
10-Oct-14	3.599	16.23	26.59	11.59	746	0.34	13.35
11-Oct-14	3.026	31.6	29.19	11.67	748	0	13.34
12-Oct-14	3.03	162.8	25.03	14.49	742	0.01	13.41
13-Oct-14	7.06	175.4	21.97	18.23	735	0.89	13.35
14-Oct-14	4.24	253.9	31.59	12.42	735	0.17	13.42
15-Oct-14	3.18	288.2	32.12	11.93	741	0	13.44
16-Oct-14	2.731	223.7	27.52	13.92	741	0	13.39
17-Oct-14	3.164	270.8	29.29	15.99	741	0	13.34
18-Oct-14	3.489	319	22.72	10.7	748	0	13.41
19-Oct-14	2.171	222.6	28.51	10.04	749	0	13.44
20-Oct-14	2.729	259.8	24.89	15.51	744	0	13.37
21-Oct-14	2.683	306.1	21.85	12.3	747	0	13.39
22-Oct-14	1.759	122.8	30.13	8.95	751	0	13.44
23-Oct-14	2.34	202.7	24.83	9.58	749	0	13.49
24-Oct-14	1.714	227	33.79	15.21	746	0	13.39
25-Oct-14	1.716	237.2	33.43	18.13	745	0	13.31
26-Oct-14	3.764	181.6	22.62	19.07	743	0	13.31
27-Oct-14	8.51	200.9	20.96	22.19	739	0	13.25
28-Oct-14	4.852	276.6	21.4	15.48	745	0.12	13.32
29-Oct-14	3.147	253.8	23.67	8.25	749	0.89	13.44
30-Oct-14	2.524	215.7	28.6	7.88	746	0.04	13.49
31-Oct-14	8.39	328.9	17.38	5.76	750	0.01	13.51

INQUEST
ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ♦ COLUMBIA, MO 65202
(573) 474-8110 ♦ FAX: (573) 474-8371

November 11, 2014

Mr. Greg Henson
Chemist
The Doe Run Company
881 Main Street
Herculaneum, Missouri 63048

RE: 4th Quarter 2014 Lead/PM10 Samplers and Meteorological System
Performance Audit Report.

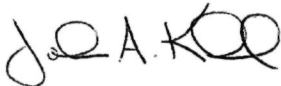
Dear Mr. Henson,

Please find enclosed the worksheets detailing the Lead/PM10 sampler's one-point flow verifications and meteorological sensors accuracy checks that were recently performed on the Doe Run Park Hills Monitoring Network. A copy of the current certifications for the audit devices that were used has also been enclosed.

All of the verifications and checks were found to be within expected guidelines.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for your business.

Sincerely,



John A. Kunkel
Inquest Environmental, Inc.

PM10 Sampler Verifications

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 Primary PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P2952	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.067	23.80	44.45	0.942	1.141	6.94	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.30	43.52	0.943	1.142	1.063	-5.93	± 10%

Calculations:

Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River	Intercept (Qa)	-0.00227
Sampler	#4 QA PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P1019	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.20	1.084	25.00	46.69	0.939	1.150	6.09	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.80	46.32	0.939	1.150	1.080	-4.42	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P2950	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.20	1.084	23.20	43.33	0.943	1.140	5.17	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.50	43.89	0.943	1.140	1.081	-4.34	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St. Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P4353	Station Pressure	30.14 "Hg 765.6 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.062	23.40	43.70	0.943	1.127	6.12	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.50	43.89	0.943	1.158	1.087	-3.81	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Hanley Park	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P2949	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.062	23.10	43.14	0.944	1.135	6.87	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.158	1.078	-4.60	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Water Plnt)	Intercept (Qa)	-0.00227
Sampler	#3 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P2951	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.20	1.079	23.10	43.14	0.944	1.141	5.75	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.10	43.14	0.944	1.141	1.075	-4.87	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Quarry)	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P4601	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.066	23.40	43.70	0.943	1.115	4.60	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.116	1.065	-5.75	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST

Environmental, Inc.

PM10 Sampler Audit

Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines (Wood Street)	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	25.0 °C 298.2 °K
Flow Controller	P4507	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.10	1.064	23.40	43.70	0.943	1.132	6.39	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.60	44.08	0.942	1.131	1.059	-6.28	± 10%

Calculations:

Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P1018	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.20	1.084	22.90	42.77	0.944	1.158	6.83	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.158	1.079	-4.51	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood (school)	Intercept (Qa)	-0.00227
Sampler	#2 PM10	Temperature	26.1 °C 299.3 °K
Flow Controller	P6071	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.30	1.101	22.90	42.77	0.944	1.168	6.09	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.168	1.097	-2.92	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.**PM10 Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood (south)	Intercept (Qa)	-0.00227
Sampler	#1 PM10	Temperature	23.8 °C 297.0 °K
Flow Controller	P1500	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.30	1.097	23.40	43.70	0.943	1.152	5.01	± 7%

Sampler Operating Flow Rate						
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.152	1.094	-3.19	± 10%

Calculations:Pressure mmHg (Pf) - ("H₂O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Lead/TSP Sampler Verifications

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River Primary	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P4557	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.165	24.60	45.96	0.940	1.233	5.84	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
24.70	46.15	0.940	1.233	1.161	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

INQUEST
Environmental, Inc.**Lead Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Big River QA	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P1019	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.50	1.133	24.20	45.21	0.941	1.153	1.77	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
24.00	44.84	0.941	1.153	1.133	1.10 - 1.70

Calculations:Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	National Ozark Insulation	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P2939	Station Pressure	30.10 "Hg 764.5 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.165	23.50	43.91	0.943	1.233	5.84	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.40	43.72	0.943	1.233	1.161	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	St Joe Park	Intercept (Qa)	-0.00227
Sampler	#4 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P6792	Station Pressure	30.14 "Hg 765.6 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.160	23.30	43.53	0.943	1.224	5.52	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.20	43.35	0.943	1.224	1.156	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Quarry	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P2940	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.149	24.10	45.03	0.941	1.227	6.79	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
24.30	45.40	0.941	1.227	1.144	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Wood St.	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	25.0 °C 298.2 °K
Flow Controller	P2941	Station Pressure	30.11 "Hg 764.8 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.147	23.80	44.47	0.942	1.227	6.97	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.80	44.47	0.942	1.227	1.141	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood Mill Street	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P1018	Station Pressure	30.09 "Hg 764.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.50	1.133	23.40	43.72	0.943	1.157	2.12	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.30	43.53	0.943	1.157	1.132	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood School	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	26.1 °C 299.3 °K
Flow Controller	P6793	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.150	23.30	43.53	0.943	1.223	6.35	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.50	43.91	0.943	1.223	1.145	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Leadwood South	Intercept (Qa)	-0.00227
Sampler	#1 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4559	Station Pressure	30.08 "Hg 764.0 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.70	1.161	23.80	44.47	0.942	1.237	6.55	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.942	1.237	1.156	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Calibration Orifice Certification Worksheet

INQUEST Environmental, Inc.

Lead Sampler Audit Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Hanley Park	Intercept (Qa)	-0.00227
Sampler	#2 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4474	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.144	23.60	44.09	0.942	1.213	6.03	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.942	1.213	1.140	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H₂O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

INQUEST
Environmental, Inc.**Lead Sampler Audit**
Volumetric Flow Control3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	October 8, 2014	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.03497
Station	Rivermines Water Plant	Intercept (Qa)	-0.00227
Sampler	#3 TSP	Temperature	23.8 °C 297.0 °K
Flow Controller	P4475	Station Pressure	30.13 "Hg 765.3 mmHg

Flow Rate Audit							
Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H ₂ O	Flow Rate m ³ /min	Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min		
3.60	1.144	23.70	44.28	0.942	1.220	6.64	± 7%

Sampler Operating Flow Rate					
Manometer "H ₂ O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m ³ /min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.220	1.139	1.10 - 1.70

Calculations:Pressure mmHg (Pf) - "H₂O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)



TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVELAND, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 09, 2014 Rootsmeter S/N 0438320 Ta (K) - 292
Operator Tisch Orifice I.D. - 1882 Pa (mm) - 759.46

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3530	4.1	1.50
2	NA	NA	1.00	1.0430	6.8	2.50
3	NA	NA	1.00	0.9510	8.1	3.00
4	NA	NA	1.00	0.8790	9.5	3.50
5	NA	NA	1.00	0.6660	16.3	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
1.0143	0.7496	1.2368	0.9945	0.7350	0.7594
1.0106	0.9690	1.5967	0.9910	0.9501	0.9804
1.0089	1.0608	1.7491	0.9893	1.0402	1.0740
1.0070	1.1456	1.8893	0.9874	1.1233	1.1600
0.9978	1.4983	2.4736	0.9784	1.4691	1.5188
Qstd slope (m) =		1.65282	Qa slope (m) =		1.03497
intercept (b) =		-0.00370	intercept (b) =		-0.00227
coefficient (r) =		0.99999	coefficient (r) =		0.99999
y axis = SQRT[H2O(Pa/760) (298/Ta)]			y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol [(Pa-Diff. Hg)/760] (298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{ [SQRT(H2O(Pa/760) (298/Ta))] - b}
Qa = 1/m{ [SQRT H2O(Ta/Pa)] - b}

Meteorological Sensor's Accuracy Checks

Inquest Environmental, Inc.

Wind Direction Sensor Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Technician M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Mfg RM Young
 Sensor Model Wind Monitor AQ
 Serial Number 128618
 Sensor Height 10.0 Meters

Station Declination 0.0 Deg
 Measured Angle 180.0 Deg
 Corrected Angle 180.0 Deg
 Alignment Error 0.0 Deg

Vane Angle Degrees	Data Logger Degrees	Results	
		Difference ± 3 Deg Limit	Total Error ± 5 Deg Limit
0/360	0.6	0.6	0.6
90	89.7	-0.3	-0.3
180	181.1	1.1	1.1
270	270.4	0.4	0.4

Average Difference (Degrees)	0.4
Average Total Error (Degrees)	0.4

Audit Device	Wind Vane Alignment	Direction
Type	Pocket Transit	Vane Angle Fixture
Mfg.	Brunton	R.M. Young
Model	5008	18212
Serial No.	5080304492	None

Comments: Wind direction was verified by determining the orientation of the sensor in respect to True North. This was measured using a tri-pod mounted transit aligned along the length of the sensor while locked from rotating. A magnetic declination of 0 degrees was used to determine True North. The linearity of the sensor was determined by aligning the sensor to an indexed test fixture provided by the manufacturer. The four cardinal directions were verified using the fixture. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Wind Speed Sensor Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Auditor(s) M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Mfg RM Young
 Sensor Model Wind Monitor AQ
 Serial Number 128618
 Sensor Height 10.0 Meters

Audit Standard		DAS Response		Limit
RPM	MPH	MPH	Difference	MPH
Zero	0.00	0.00	0.00	0.45
300	3.44	3.43	-0.01	0.62
600	6.87	6.87	0.00	0.79
1200	13.74	13.74	0.00	1.14
1800	20.61	20.61	0.00	1.48
3600	41.22	41.20	-0.02	2.51
5400	61.83	61.80	-0.03	3.54
Average			-0.01	

± (0.45 MPH + 5%)

Audit Device	Anemometer Drive
Type	Variable Speed
Mfg.	R.M. Young
Model	18801
Serial No.	CAO1631

Comments: Wind speed was verified using a variable speed anemometer drive. The propellor was removed from the sensor and the drive was connected using a flexible connector. The sensor was then rotated in the appropriate direction at several different speeds. Sensor responses were taken from the data logger. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Temperature Sensor Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Technician M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Information

Sensor Mfg Climatronics
 Sensor Model NA
 Serial Number NA
 Sensor Height 2 meters

Audit Device °C	Sensor	
	Data Logger °C	Difference °C
0.0	0.2	0.2
17.7	17.9	0.2
35.1	35.4	0.3
Average		0.2

Note: The limit for each point is +/- 0.5 °C

Audit Device	
Type	Digital Thermometer
Mfg.	Control Company
Model	15-077-7
Serial No.	72415694

Comments: The temperature is verified by co-locating the sensor with a certified digital thermometer. The verification is conducted at three levels using two water baths (iced and hot water) and the ambient temperature. The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital thermometer. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Barometric Pressure Sensor Performance Audit

Operator The Doe Run Co
 Location Big River
 Station Name Meteorological System
 Technician M Kunkel / C Boston

Date 10/29/2014
 Start Time 11:15
 Stop Time 12:30

Sensor Mfg Setra
 Sensor Model 276
 Serial Number 2626447

Audit Device	Data Logger Response	
	BP mm HG	Difference mm HG
745.60	749.62	4.02

Note: Limit is +/- 7.5 mm HG.

Audit Device	
Type	Digital Barometer
Mfg.	AIR
Model	AIR-HB-1A
Serial No.	6G3745

Comments: The barometric pressure is verified by co-locating the sensor with a certified
digital barometer. The verification was conducted at one level after
allowing the sensor and calibration device ample time to stabilize.
The sensor error was determined by comparing the sensor's data logger
response to the display on the certified digital barometer. No
adjustments were made to the sensor.

Inquest Environmental, Inc.

Precipitation Gauge Performance Audit

Operator The Doe Run Co
Location Big River
Station Name Meteorological System
Technician M Kunkel / C Boston

Date 10/29/2014
Start Time 11:15
Stop Time 12:30

Sensor Mfg Texas Electronics
Sensor Model TR525I
Serial Number 36611-805
Diameter (inches) 6.00

Audit Device Known Tips	Data Logger Response	
	Gauge Tips	Difference %
96.00	89.00	-7.29

Note: Limit is +/- 10%.

Audit Device	
Type	Graduated Beaker
Mfg.	Texas Instruments
Model	FC-525
Serial No.	NA

Comments: The precipitation gauge output was verified using a field calibration kit
supplied by the manufacturer. The kit consists of a graduated beaker
and a calibration funnel using a precision orifice at the water outlet.
Water was measured in the beaker and poured into the funnel while
mounted on the gauge. The amount of precipitation recorded by the
data logger was then compared to the known amount of water passing
through the funnel. 100 tips equals one inch of rainfall. The gauge
was cleaned and no adjustments were made.

Meteorological Audit Devices Certifications

BRUNTON OUTDOOR GROUP

CERTIFICATE OF CALIBRATION

Equipment Owner

Name: Environmental Atten: Mitchell Kunkel
Address: 3609 Mojave Court Ste E
Columbia, MO 65202

Calibration traceable to the National Institute of Standards and Technology in accordance with MIL-STD-45662A has been accomplished on the instrument listed below by comparison with standards maintained by the Brunton Outdoor Group. The accuracy and stability of all standards maintained by the Brunton Outdoor Group are traceable to national standards maintained by the National Institute of Standards and Technology in Washington, D.C. and Boulder, CO. Completed record of all work performed is maintained by the Brunton Outdoor Group and is available for inspection upon request.

This unit has been calibrated to Lietz TM10E serial number 30937 traceable to N.B.S. Number 738227675 this 16TH Day May 20 13.

Description Pocket Transit

Purchase Order RA 256426895

Order Number SO-042272

Model Number F-5008

Serial Number 5080304492

Calibration Date May 16, 2013

Recalibration Date May 16, 2014

Signed Arthur K. Shuster

Quality Control Coordinator



CALIBRATION PROCEDURE
18801/18810 ANEMOMETER DRIVE

DWG: CP18801(A)

REV: C101107

PAGE: 2 of 3

BY: TJT

DATE: 10/11/07

CHK: JC

W.C. GAS-12

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: **18801** (Comprised of Models 18820 Control Unit & 18830 Motor Assembly)
SERIAL NUMBER: CA01631

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	Output Frequency Hz (1)	Calculated Rpm (2)	Indicated Rpm (3)
600	320	600	600
1200	640	1200	1200
2400	1280	2400	2400
4200	2240	4200	4200
6,000	3200	6000	6000
8,100	4320	8100	8100
9,900	5280	9900	9900

☒ Clockwise and Counterclockwise rotation verified

- (1) Measured at the optical encoder output.
(2) Frequency output produces 32 pulses per revolution of motor shaft.
(3) Indicated on the Control Unit LCD display.

* Indicates out of tolerance

☒ No Calibration Adjustments Required

☐ As Found

☐ As Left

Traceable frequency meter used in calibration Model: DP5740 SN: 4683

Date of inspection 15 Nov 2013
Inspection Interval One Year

Tested By EC



Calibration complies with ISO/IEC
17025, ANSI/NCCL Z540-1, and 9001



Cert. No.: 4000-5654260

Calibration
Certificate No. 1750.01

Traceable® Certificate of Calibration for Digital Thermometer

Cust ID: Inquest Environmental Inc., 3609 Mojave Ct. Suite E, Attn. Mitchell Kunkel, Columbia, MO 65202 U.S.A. (RMA:983601)

Instrument Identification:

Model Numbers: 15-077-8, FB50266, 245BY S/N: 21357521 Manufacturer: Control Company

Model: 15-077-7 S/N: 72415694

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/13/14	1000332071
Temperature Probe	128	2/20/14	6-B48Z9-30-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5202	11/30/14	15-B15PW-1-1
Temperature Calibration Bath TC-275	B16388		
Digital Thermometer	B16815	8/12/14	1000341967
PRT Temperature Probe	02022	8/14/15	B3812004

Certificate Information:

Technician: 68

Procedure: CAL-06

Cal Date: 1/17/14

Cal Due: 1/17/15

Test Conditions: 24.5°C 32.0 %RH 1026 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	0.006	Y	0.000	0.000	Y	-0.050	0.050	0.013	3.8:1
°C	25.003	25.003	Y	25.003	24.999	Y	24.953	25.053	0.023	2.2:1
°C	60.000	59.988	Y	60.000	60.002	Y	59.950	60.050	0.014	3.6:1
°C	99.998	99.961	Y	99.998	100.000	Y	99.948	100.048	0.018	2.8:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez
Nicol Rodriguez, Quality Manager

Aaron Judice
Aaron Judice, Technical Manager

Maintaining Accuracy:

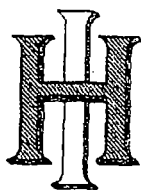
In our opinion once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be effected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).



HASS INSTRUMENT CORPORATION

6711 OLD BRANCH AVENUE • CAMP SPRINGS, MD 20748-6990 • (301) 449-5454 • FAX (301) 449-5455

CALIBRATION REPORT

BAROMETER/ALTIMETER
AIR Model AIR-HB-1A
Serial No. 6G3745

TEST POINT	TEST <u>PRESSURE</u>	DIGITAL READOUT	READOUT ERROR	CORRECTION REQUIRED
1	930.00	931.9	+1.9	-1.9
2	970.00	971.9	+1.9	-1.9
3	1010.00	1012.0	+2.0	-2.0
4	1050.00	1051.9	+1.9	-1.9
5	1018.01	1019.9	+1.9	-1.9

NOTES:

1. All data are in Millibars (hPa) and were taken at 75 F (24 C).
2. To correct the Digital Readout of the instrument, either algebraically add the CORRECTION REQUIRED to, or algebraically subtract the READOUT ERROR from, the readout shown on the instrument.
3. The TEST PRESSURE was generated using Type A-1 Barometer S/N 3327, and was approached in an increasing-pressure direction.
4. The TEST PRESSURE for TEST POINT 5 was ambient atmospheric pressure.
5. The BAROMETER/ALTIMETER was horizontal during the calibration.
6. The LCD screen of the BAROMETER/ALTIMETER has some trash in the center of the display, but it does not interfere with the readout.
7. Although the Digital Readout of the instrument can be adjusted to incorporate the average CORRECTION REQUIRED, this has not been done.

Calibration Date: 5 February 2014

(SEAL)

By: Bernard I. Hass

Bernard I. Hass